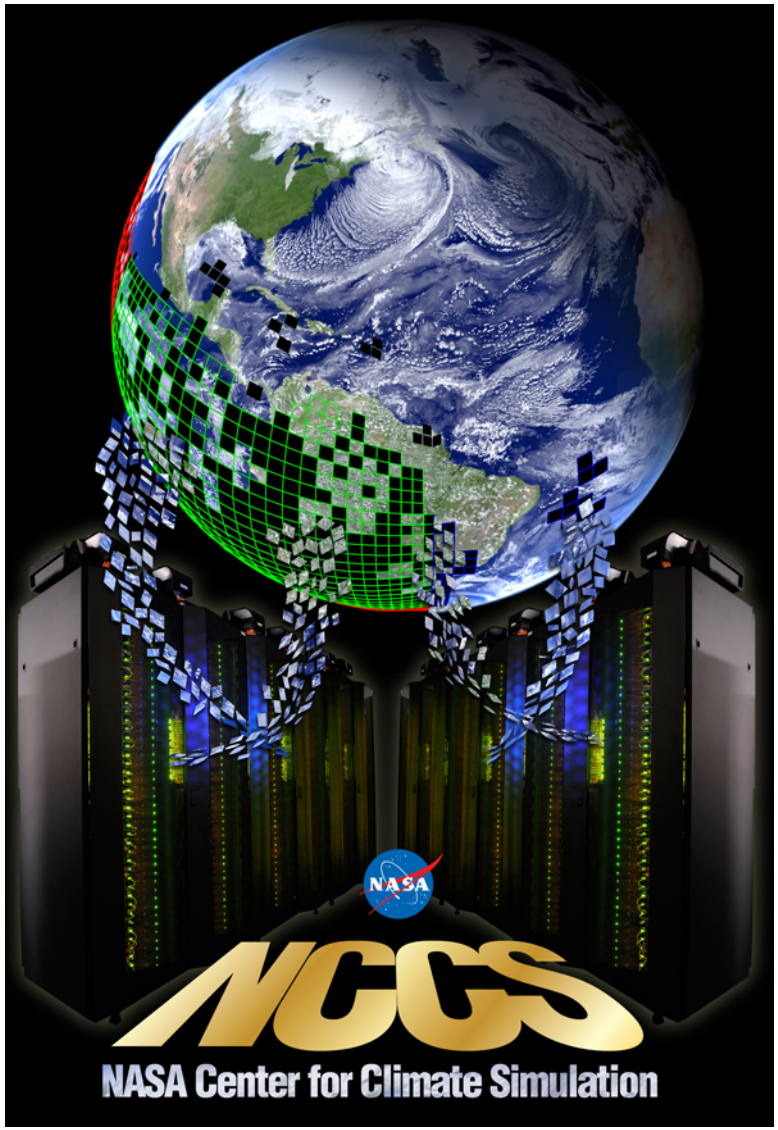
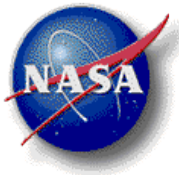
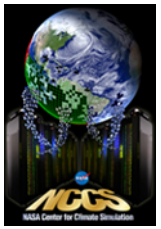


NCCS Brown Bag Series





Introduction to Python Matplotlib

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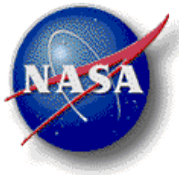
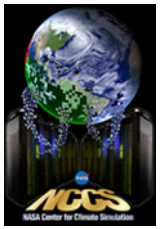
February 12, 2013

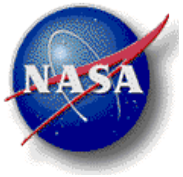


Agenda

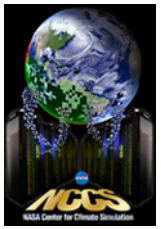


- How is Matplotlib related to Python?
- Major differences between Matplotlib and Matlab
- Look at a simple matlab file translation.
- First example
- 3 examples of Matplotlib:
  1. Create a Sea Surface Temperature (SST) picture using Reynolds data.
  2. Create same SST image using basemap and adding a color bar.
  3. Create a timeseries of March 2012 using MERRA data.

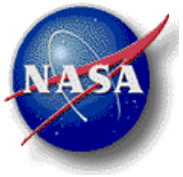
- Questions



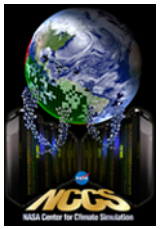
Python relation with Matplotlib



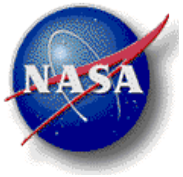
- Python is an interpreted, object-oriented, high-level programming language.
- Python and Perl come from a similar background (Unix scripting, which both have long outgrown), but have a different philosophy. Python comes close to Perl; however Python has an applicability well beyond Perl's niche.
- Python supports modules and packages, which encourages program modularity and code reuse.
- Matplotlib is a python module:
  - Simply, a module is a file consisting of Python code. A module can define functions, classes, and variables. A module can also include runnable code.



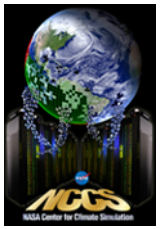
Major differences



- Matplotlib is probably the most popular 2D graphic interface.
  - There is a package called Matplot3D
- Matplotlib has a “Matlab-like” API interface.
- Matlab use 1 base indexing and Matplotlib use 0 based indexing
  - Initial sequence is found at (1) in Matlab and at (0) in Matplotlib.
- Matlab array is passed by value, Matplolib passes by references.
- Matlab community is limited by cost, although very active.
- Matplotlib also has a very active community and is free.
- Matlab is a full development environment, (IDE, debugger).



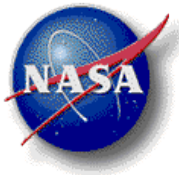
Major differences



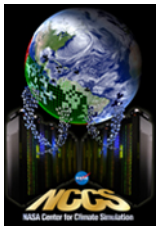
- Python's syntax: example Python has no end keyword.
- Python arrays and slices are indexed with [] not ().

- From users:
  - Yes, you want to use matplotlib for plotting, it has pretty much the same capabilities as Matlab's plotting interface.

- Tip to translate from matlab to matplotlib:
  - read into the Python package documentation for a method that does what you want. This may not exist, but I'm betting that in a simple program, you will find most of the ones you need.



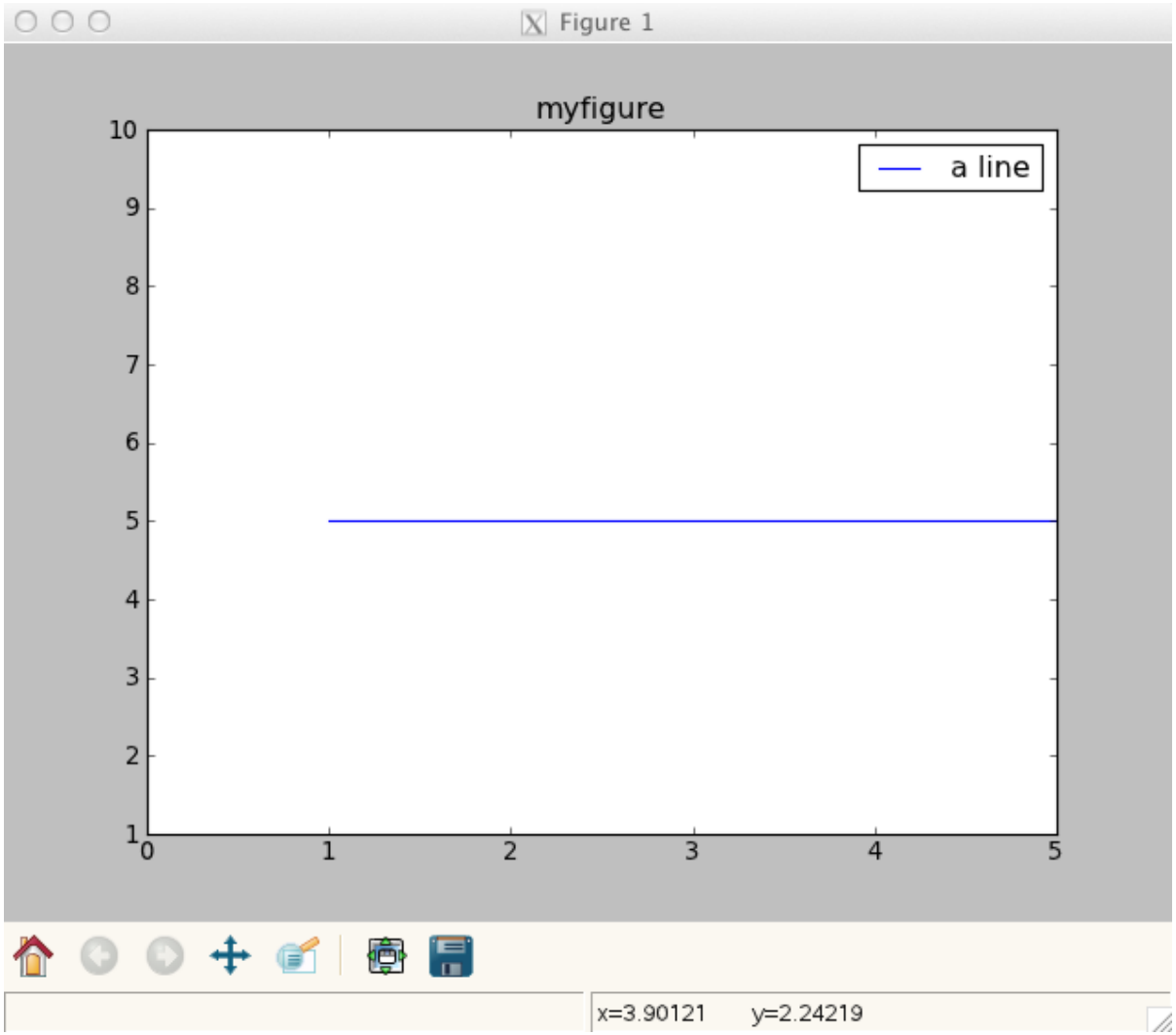
First example

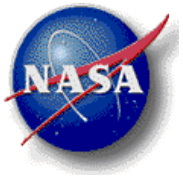


```
% Matlab example

% create figure and return figure handle
h = figure();
% add a plot and tag it
plot(1:10, 1:10, 'Tag', 'dummy')

% add a legend
my_legend = legend('a line')
% change figure name
set(h, 'name', 'myfigure')
% get current axes
my_axis = gca();
% change xlimits
set(my_axis, 'XLim', [0 5])
%find object and modify data
set(findobj('Tag', 'dummy'), 'YData',
        repmat(10, 1, 5)
```

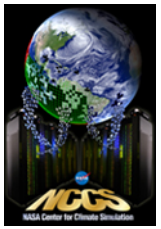
```
import matplotlib.pyplot as plt
import numpy as np
# create a figure and return handle
h = plt.figure()
# add a plot and tag it
plt.plot(range(1,11), range(1,11),
gid='dummy')
# add a legend
my_legend = plt.legend(['a line'])
# Change figure name
plt.title("myfigure")
# get current axes
my_axis = plt.gca()
# Change limit
my_axis.set_xlim(0,5)
for p in set(h.findobj(lambda x:
x.get_gid()=='dummy')):
    p.set_ydata(np.ones(10)*5.0)
plt.show()
```

First example



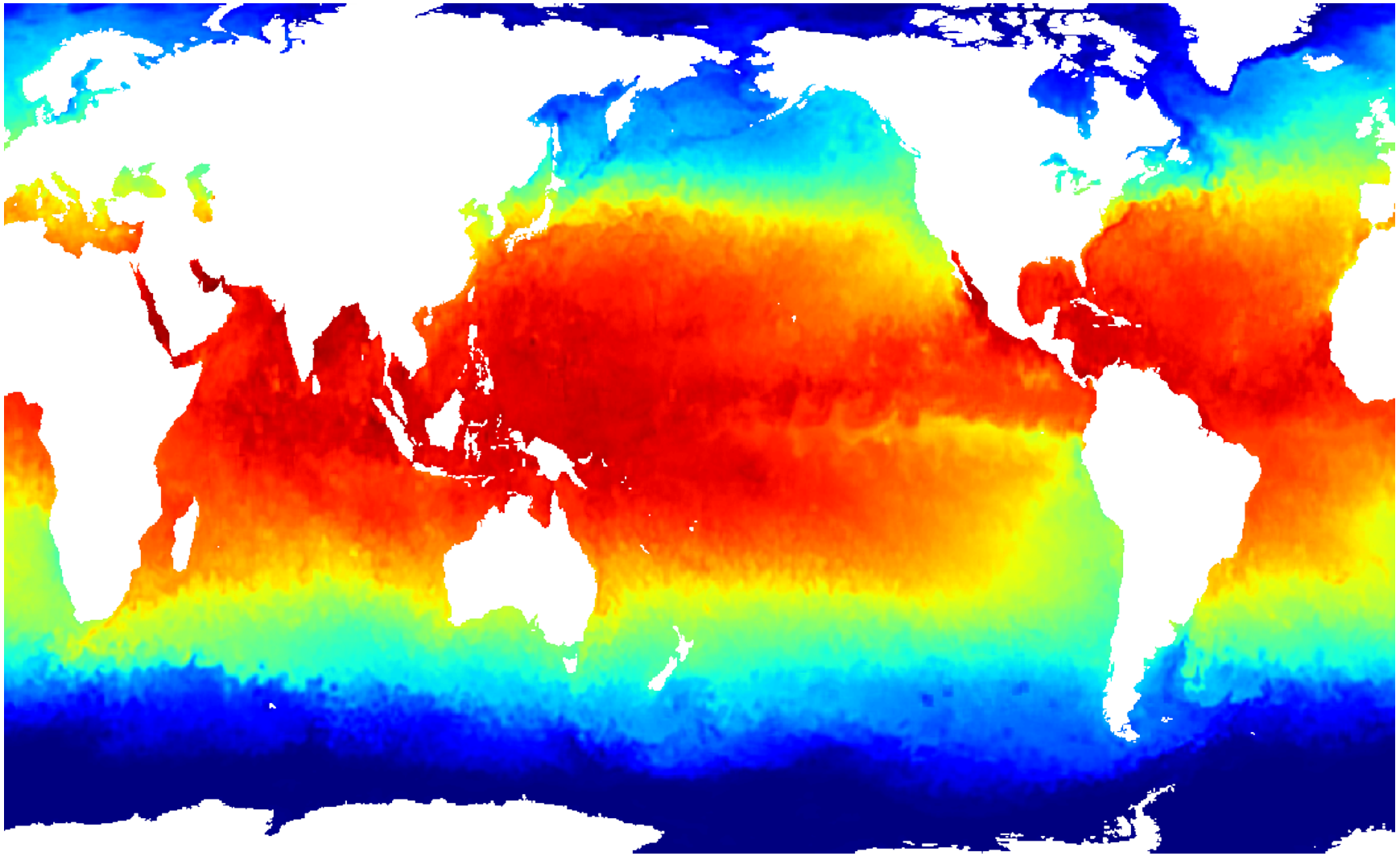


3 examples of Matplotlib

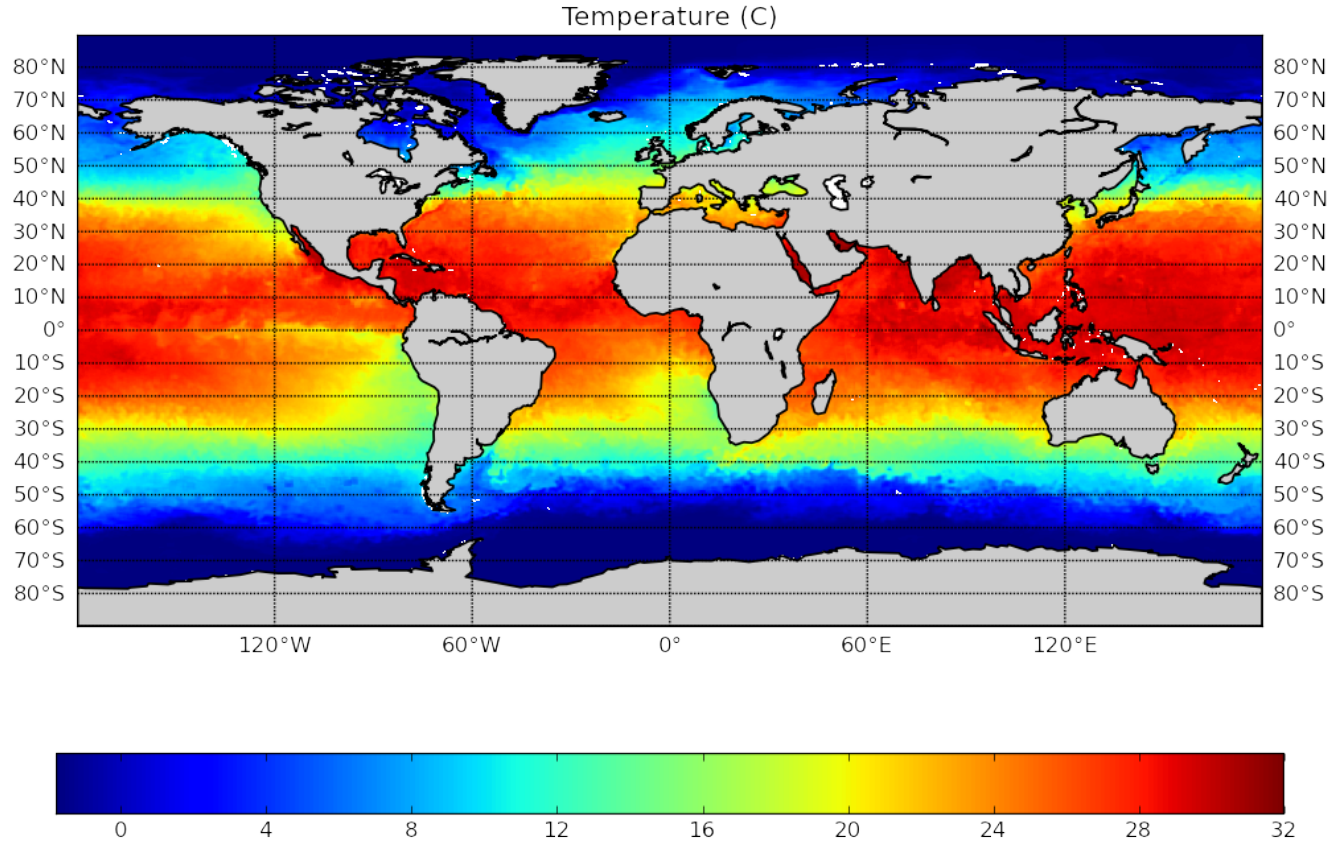


1. Create a Sea Surface Temperature (SST) picture using Reynolds data
2. Create a SST basemap with color bar.
3. Create a timeseries of March 2012.
   - Use MERRA data (HDFEOS)
   - Add legend
   - Add “inset” image to overly station over a monthly mean.

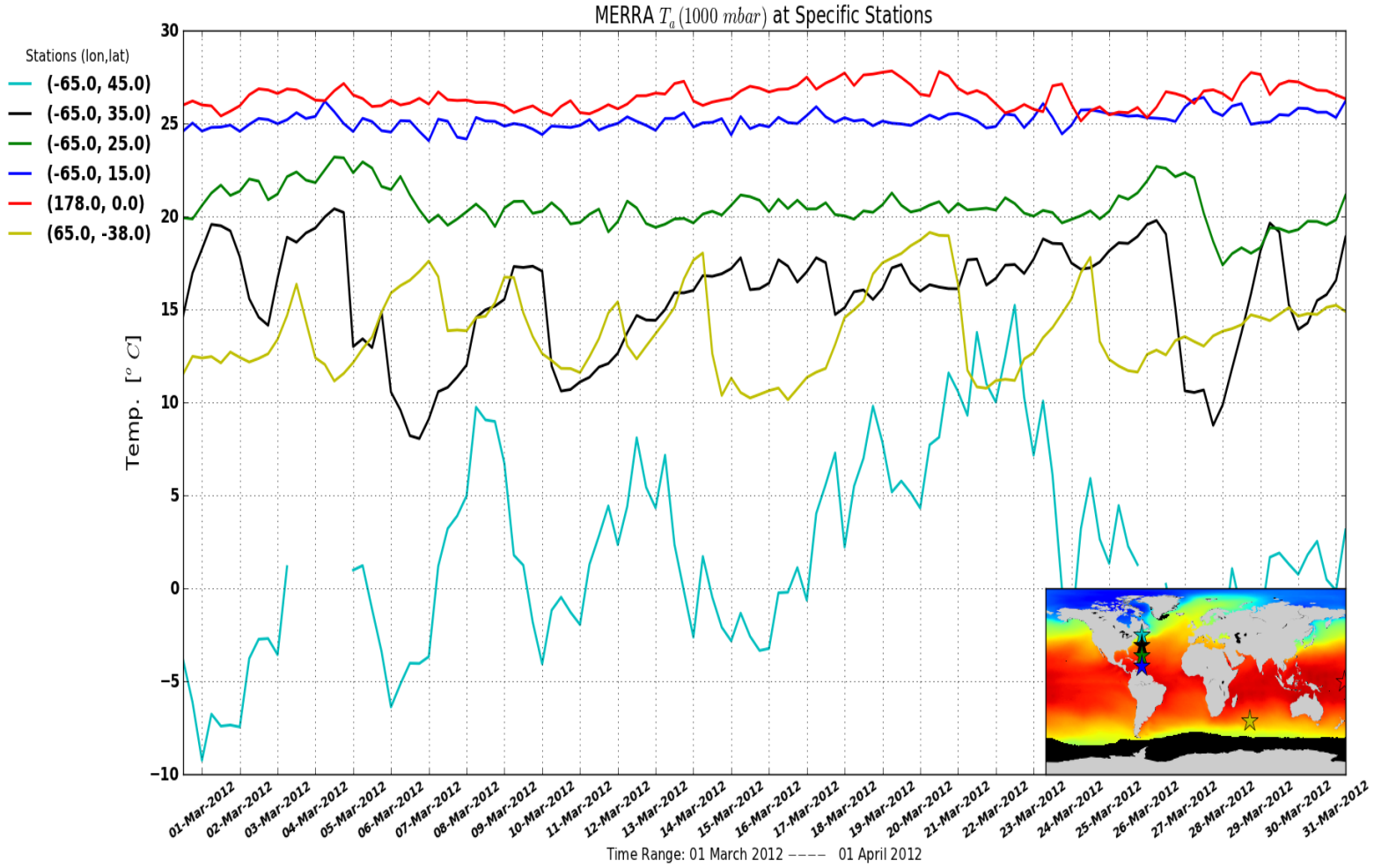
Create a Sea Surface Temperature (SST) using Reynolds data.



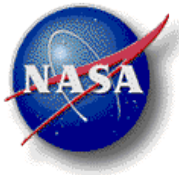
Create a SST basemap with color bar.



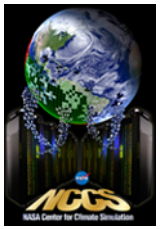
Create timeseries using MERRA (March 2012)



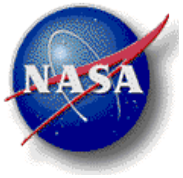
NASA Center for Climate Simulation



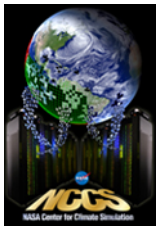
Interesting links



- http://www.scipy.org/NumPy_for_Matlab_Users
- http://sourceforge.net/projects/mat2py/
- http://sourceforge.net/projects/libermate/
- http://matplotlib.org



Questions?



- Thanks to:
  - Santha Akella,
  - Guillaume Verniere.
  - Austin Conaty
  - GMAO